

# A Nightly Bedtime Routine: Impact on Sleep in Young Children and Maternal Mood

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**Background:** Establishment of a consistent bedtime routine is often recommended to parents of young children, especially those with sleep difficulties. However, no studies have investigated the efficacy of such a routine independent of behavioral intervention. Thus, the purpose of this study was to examine the impact of a consistent bedtime routine on infant and toddler sleep, as well as maternal mood.

**Methods:** 405 mothers and their infant or toddler (ages 7-18 months,  $n = 206$ ; ages 18-36 months,  $n = 199$ ) participated in 2 age-specific 3-week studies. Families were randomly assigned to a routine or control group. The first week of the study served as a baseline during which the mothers were instructed to follow their child's usual bedtime routine. In the second and third weeks, mothers in the routine group were instructed to conduct a specific bedtime routine, while the control group continued their child's usual routine. All mothers completed the Brief Infant Sleep Questionnaire (BISQ) on a weekly basis and a daily sleep diary, as well as completed the Profile of Mood States (POMS).

**Results:** The bedtime routine resulted in significant reductions in problematic sleep behaviors for infants and toddlers. Significant improvements were seen in latency to sleep onset and in number/duration of night wakings,  $P < 0.001$ . Sleep continuity increased and there was a significant decrease in the number of mothers who rated their child's sleep as problematic. Maternal mood state also significantly improved. Control group sleep patterns and maternal mood did not significantly change over the 3-week study period.

**Conclusion:** These results suggest that instituting a consistent nightly bedtime routine, in and of itself, is beneficial in improving multiple aspects of infant and toddler sleep, especially wakefulness after sleep onset and sleep continuity, as well as maternal mood.

**Keywords:** Sleep, infant, toddler, bedtime routine, bedtime disturbances, night wakings, behavioral intervention

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SLEEP PROBLEMS ARE ONE OF THE MOST COMMON CONCERNS OF PARENTS OF YOUNG CHILDREN, OCCURRING IN APPROXIMATELY 20% TO 30% OF INFANTS AND TODDLERS,<sup>1,2</sup> and one of the most common behavioral issues brought to the attention of pediatricians.<sup>3,4</sup> There are a number of studies on the efficacy of behavioral interventions for the sleep problems, and the American Academy of Sleep Medicine has even released a standards of practice document for behavioral treatment of bedtime problems and night wakings in young children.<sup>1,5</sup> Overall, it was found that of 52 treatment studies reviewed, 94% reported that behavioral interventions were efficacious and 80% of children treated demonstrated clinically significant improvement. Noteworthy was that the majority of the intervention studies reviewed included a bedtime routine as part of a multi-component treatment program. However, no studies have ever evaluated the efficacy of a bedtime routine independent of other treatments.

A bedtime routine is a common and simple behavioral intervention for sleep issues in young children, with over 90% of pediatricians recommending institution of a bedtime routine to their patients with sleep difficulties.<sup>3</sup> Research shows that daily routines in general lead to predictable and less stressful environments for young children and are related to parenting competence, improved daytime behaviors, and lower maternal

mental distress.<sup>6-8</sup> A bedtime routine is one such daily family routine and consists of parents engaging their child in the same activities in the same order on a nightly basis prior to turning out the lights ("lights out"). It is expected that a bedtime routine will similarly improve behavior and will result in children falling asleep quicker with less disruptive behaviors at bedtime.

Furthermore, in considering the efficacy of sleep-related interventions on children, it is important to note that sleep issues in young children also have a significant negative impact on parents. For example, studies have found elevated levels of depressed mood in mothers of infants and toddlers having sleep disturbances.<sup>9,10</sup> Conversely, studies indicate that successful treatment of children's sleep problems with behavioral interventions results in improvements in parental well-being.<sup>11,12</sup> Therefore, improvement in parental mood following institution of a bedtime routine is also expected given that routines overall result in reduced parental distress, as discussed above.

Thus, the overall objectives of the current studies were to examine the effects of a consistent bedtime routine on infant and toddler sleep, as well as its impact on maternal mood. We hypothesized that a bedtime routine would result in (1) decreased sleep onset latency, (2) reduction of disruptive bedtime behaviors, and (3) improved maternal mood.

## METHODS

### Participants

Overall, 405 mothers and their young child participated in 2 separate studies. The first study involved 206 mothers and

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**Table 1**—Demographic Variables

| Variable               | Infants<br>(n = 206)<br>Percent (n) | Toddlers<br>(n = 199)<br>Percent (n) |
|------------------------|-------------------------------------|--------------------------------------|
| Age of Mother          |                                     |                                      |
| 18-29                  | 31.1 (64)                           | 26.8 (53)                            |
| 30-39                  | 57.8 (119)                          | 63.1 (125)                           |
| 40-49                  | 11.2 (23)                           | 10.1 (20)                            |
| Married                | 97.1 (200)                          | 96.5 (191)                           |
| School                 |                                     |                                      |
| Graduated high school  | 16.5 (34)                           | 9.1 (18)                             |
| Some college           | 34.0 (70)                           | 32.3 (64)                            |
| College degree or more | 49.5 (102)                          | 58.6 (116)                           |
| Employed               |                                     |                                      |
| Full-Time              | 22.3 (46)                           | 23.4 (46)                            |
| Part-Time              | 22.3 (46)                           | 24.4 (48)                            |
| Not Employed           | 55.4 (114)                          | 52.3 (103)                           |
| Income                 |                                     |                                      |
| < \$30,000             | 5.3 (11)                            | 2.5 (5)                              |
| \$30,000 - \$39,999    | 18.0 (37)                           | 9.1 (18)                             |
| \$40,000 - \$49,999    | 15.0 (31)                           | 11.1 (22)                            |
| \$50,000 - \$74,999    | 34.5 (71)                           | 35.9 (71)                            |
| \$75,000 or more       | 27.2 (56)                           | 41.4 (82)                            |
| Child's Gender         |                                     |                                      |
| Boy                    | 45.6 (94)                           | 48.5 (96)                            |
| Girl                   | 54.4 (112)                          | 51.5 (102)                           |
| Child's age            |                                     |                                      |
| 7-12 months            | 43.2 (89)                           |                                      |
| 13-18 months           | 56.8 (117)                          |                                      |
| 18-24 months           |                                     | 34.9 (68)                            |
| 25-30 months           |                                     | 37.4 (73)                            |
| 31-36 months           |                                     | 27.7 (54)                            |
| Sleep location         |                                     |                                      |
| Crib                   | —                                   | 44.4 (87)                            |
| Bed                    | —                                   | 55.6 (109)                           |

their infants (ages 7-18 months; 45.6% boys) and the second study included 199 mothers and their toddlers (ages 18-36 months; 48.5% boys). Participants for each study were recruited through an independent market research firm utilizing contact lists of parents of young children and were screened by telephone (infant study) or in person (toddler study). Note that there were originally 209 families in the infant study who completed the study, however only 206 (98.6%) had complete data. Similarly, there were complete data for 199 (94.8%) of the original 210 families in the toddler study. See Table 1 for complete demographic information for all families with complete data.

Inclusion criteria for the study included that all children must have an identified sleep problem as noted by the mother, with all mothers endorsing that their child had a sleep problem that ranged from “small” to “severe.” However, families were excluded if the child had an apparent significant sleep disorder, as defined as (1) > 3 night wakings per night, (2) awake > 60 minutes per night, (3) total daily sleep duration < 9 hours. Additional exclusion criteria included: (1) non-English speaking, as all questionnaires were presented in English, (2) current acute or chronic illness, and (3) child routinely bathed before bed (after 16:00) ≥ 4 times per week, as a nightly bath was part of the bedtime routine in this study.

## Measures

### Brief Infant Sleep Questionnaire

All mothers completed an expanded version of the Brief Infant Sleep Questionnaire (BISQ).<sup>13</sup> The BISQ has been validated against actigraphy and daily-logs and its sensitivity in documenting expected developmental trends in young children's sleep and the effects of environmental factors have been established. Test-retest reliability for individual sleep measures on the BISQ was high ( $r = 0.81$  to  $0.95$ ) and Pearson between-method correlations comparing the BISQ to actigraphy for corresponding sleep measures ranged from  $r = 0.23$  to  $0.54$ . All respondents were asked to describe their child's behavior over the past week. The BISQ was completed on days 8, 15, and 22. The expanded version included background demographic information, specific questions about the child's daytime and nighttime sleep patterns, and sleep-related behaviors.

### Daily Sleep Diary

All mothers also completed a daily sleep diary that included information about their child's sleep patterns (e.g., bedtime, sleep onset latency, night wakings). The toddler diary included additional questions about sleep-related behaviors relevant to this age group, including the number of times the child called his/her parents, the number of times the child independently got out of his/her crib/bed, and the number of times the child was taken out of his/her crib/bed. In addition, parents were asked to respond on a 5-point Likert scale rating the difficulty of bedtime (1 = very easy to 5 = very difficult), how well the child slept last night (1 = very well to 5 = very badly), and the child's mood when s/he first woke up in the morning (1 = very happy to 5 = very fussy).

### Profile of Mood States (POMS)

The POMS is a well-validated measure of mood states. The 65-item scale measures 6 identified subscales: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. Each item is responded to on a 6-point Likert scale ranging from 0 = “not at all” to 5 = “extremely.” Higher scores indicate more negative mood state, except for vigor-activity, for which lower scores denote negative mood state. The POMS has high internal consistency, as well as predictive and constructive validity.

### Procedure

These studies were approved by an institutional review board, and informed consent was obtained from all participants. All families were paid \$150-200 for their participation, and no families were informed of the sponsor of this study.

### Infant Study

Of the total 206 families, 134 (65%) families were assigned to the routine group. Following a one-week baseline period in which the mothers followed their child's usual bedtime prac-

**Table 2**—Sleep-Wake Patterns for Infants (BISQ)

| Variable                                | Baseline<br>M (SD) | Week 2<br>M (SD) | Week 3<br>M (SD) | ANOVA    |         |
|---|--------------------|------------------|------------------|----------|---------|
|   |                    |                  |                  | F        | P       |
| Sleep latency (min)                     |                    |                  |                  |          |         |
| Control                                 | 20.2 (14.28)       | 17.9 (11.58)     | 14.9 (8.69)      | 3.45     | 0.03    |
| Intervention <sup>a</sup>               | 20.8 (13.76)       | 13.1 (9.17)      | 12.4 (9.65)      | 23.24*** | < 0.001 |
| Number of night wakings                 |                    |                  |                  |          |         |
| Control                                 | 1.5 (0.89)         | 1.4 (0.85)       | 1.4 (0.97)       | 0.83     | 0.44    |
| Intervention <sup>a</sup>               | 1.6 (0.86)         | 1.0 (0.73)       | 1.0 (0.76)       | 30.99*** | < 0.001 |
| Duration of night wakings (min)         |                    |                  |                  |          |         |
| Control                                 | 23.5 (26.02)       | 22.2 (25.56)     | 18.9 (21.33)     | 0.66     | 0.52    |
| Intervention <sup>a</sup>               | 21.8 (12.75)       | 14.8 (11.90)     | 12.6 (11.79)     | 20.90*** | < 0.001 |
| Longest continuous sleep period (hours) |                    |                  |                  |          |         |
| Control                                 | 8.0 (2.87)         | 8.5 (2.78)       | 8.5 (2.49)       | 0.76     | 0.47    |
| Intervention <sup>a</sup>               | 7.6 (2.27)         | 8.9 (2.47)       | 9.3 (2.46)       | 18.23*** | < 0.001 |
| Total nighttime sleep (hours)           |                    |                  |                  |          |         |
| Control                                 | 9.6 (1.36)         | 9.4 (1.67)       | 9.5 (1.52)       | 0.56     | 0.57    |
| Intervention <sup>b</sup>               | 9.5 (1.41)         | 9.8 (1.52)       | 10.1 (1.40)      | 5.12**   | 0.006   |
| Total naps (hours)                      |                    |                  |                  |          |         |
| Control                                 | 2.5 (1.08)         | 2.4 (0.98)       | 2.5 (1.00)       | 0.05     | 0.95    |
| Intervention                            | 2.2 (0.96)         | 2.2 (0.91)       | 2.3 (1.17)       | 0.57     | 0.57    |
| Consider sleep a problem <sup>+</sup>   |                    |                  |                  |          |         |
| Control                                 | 1.6 (0.59)         | 1.7 (0.68)       | 1.7 (0.66)       | 0.05     | 0.95    |
| Intervention <sup>a</sup>               | 1.9 (0.56)         | 1.4 (0.55)       | 1.3 (0.50)       | 43.57*** | < 0.001 |
| Baby's mood in morning <sup>^</sup>     |                    |                  |                  |          |         |
| Control                                 | 1.9 (0.82)         | 1.9 (0.87)       | 1.7 (0.81)       | 0.99     | 0.37    |
| Intervention <sup>a</sup>               | 2.4 (0.95)         | 1.8 (0.73)       | 1.7 (0.83)       | 23.81*** | < 0.001 |

<sup>a</sup>Significant difference between baseline/week 2 and baseline/week 3; <sup>b</sup>Significant difference between baseline and week 3; <sup>+</sup>Higher scores are better; <sup>^</sup>Lower scores are better; BISQ: Brief Infant Sleep Questionnaire; min: minutes; SD: standard deviation

tices, the mothers were instructed to institute a nightly 3-step bedtime routine for a 2-week period that included a bath (using a provided wash product), a massage (using a provided massage product), and quiet activities (e.g., cuddling, singing lullaby), with lights out within 30 minutes of the end of the bath. All mothers were provided with the same products in unmarked containers. Mothers continued to put their child to bed as they normally did, whether they put their child to bed awake or stayed with their child until asleep (e.g., rocked to sleep). Thus, the only recommended change was the institution of the prescribed bedtime routine. Seventy-two (35%) families participated as controls. These mothers were instructed to follow their child's usual bedtime practices throughout the entire 3-week period. They were informed that the study was about children's bedtime activities and sleep behaviors.

### **Toddler Study**

Of the 200 families with toddlers, 133 (66.5%) families were randomly assigned to the routine group and 67 (33.5%) to the control group. The overall research design was identical to the infant study, although the bedtime routine included instructions to apply lotion (using a provided product) rather than massage, as this was a more age-appropriate activity. The mothers continued to put their child to bed as they normally did, whether they put their child to bed awake or stayed with their child until asleep. Thus, as previously stated, the only changes made were the institution of the prescribed bed-

time routine. Control families were instructed to follow their child's usual bedtime practices throughout the entire 3 weeks. They were also informed that the study was related to bedtime activities and sleep behaviors.

### **Data Analyses**

Descriptive analyses (means, frequencies) were used to describe demographic and sleep variables. Preliminary analyses, including analysis of variance (ANOVA) and chi-square tests, were conducted to evaluate whether there were any demographic differences between the control group and the routine group that would need to be controlled for when conducting between-group analyses; however, none were noted. Similar analyses were conducted to determine whether sleep patterns differed between the 2 groups. Although randomly assigned, there were significant differences in sleep patterns at baseline in both the infant and toddler study. Specifically, there were significant differences between the control infants and routine infants at baseline for night wakings, consolidated sleep, parent perception of sleep problems, and child's morning mood,  $P < 0.05$ . Overall, infants in the control group were better sleepers. Similarly, toddlers in the routine group were better sleepers, having fewer night wakings and greater consolidated sleep than those randomly assigned to the control group,  $P < 0.05$ . Therefore, individual repeated measures one-way ANOVAs were conducted separately for each variable within the control groups and the routine groups, followed by Tukey HSD post hoc testing. Be-

**Table 3**—Sleep-Wake Patterns for Toddlers (BISQ)

| Variable                                | Baseline<br>M (SD) | Week 2<br>M (SD) | Week 3<br>M (SD) | ANOVA    |         |
|---|--------------------|------------------|------------------|----------|---------|
|   |                    |                  |                  | F        | P       |
| Sleep latency (min)                     |                    |                  |                  |          |         |
| Control                                 | 21.8 (15.14)       | 21.1 (15.91)     | 2.6 (13.50)      | 0.11     | 0.90    |
| Intervention                            | 20.3 (11.55)       | 16.9 (11.94)     | 16.3 (12.05)     | 4.31     | 0.01    |
| Number of night wakings                 |                    |                  |                  |          |         |
| Control                                 | 1.1 (0.70)         | 1.2 (1.08)       | 1.0 (1.01)       | 0.35     | 0.71    |
| Intervention <sup>a</sup>               | 1.3 (0.85)         | 0.9 (0.75)       | 0.6 (0.71)       | 25.61*** | < 0.001 |
| Duration of night wakings (min)         |                    |                  |                  |          |         |
| Control                                 | 15.1 (14.60)       | 14.4 (14.84)     | 13.3 (15.65)     | 0.24     | 0.79    |
| Intervention <sup>a</sup>               | 14.8 (13.16)       | 10.0 (12.19)     | 8.2 (9.85)       | 11.22*** | < 0.001 |
| Longest continuous sleep period (hours) |                    |                  |                  |          |         |
| Control                                 | 8.8 (1.97)         | 8.5 (1.84)       | 8.5 (1.91)       | 0.33     | 0.72    |
| Intervention <sup>a</sup>               | 8.1 (2.05)         | 8.7 (2.11)       | 9.2 (1.93)       | 9.22***  | < 0.001 |
| Total nighttime sleep (hours)           |                    |                  |                  |          |         |
| Control                                 | 9.8 (1.10)         | 9.8 (1.10)       | 10.0 (1.00)      | 0.37     | 0.69    |
| Intervention                            | 9.9 (.94)          | 9.9 (.95)        | 10.0 (.89)       | 0.50     | 0.61    |
| Total naps (hours)                      |                    |                  |                  |          |         |
| Control                                 | 1.8 (0.79)         | 1.7 (0.64)       | 1.7 (0.80)       | 0.46     | 0.63    |
| Intervention                            | 1.9 (0.76)         | 1.7 (0.76)       | 1.8 (0.76)       | 0.82     | 0.44    |
| Consider sleep a problem <sup>^</sup>   |                    |                  |                  |          |         |
| Control                                 | 2.6 (0.98)         | 2.4 (0.95)       | 2.4 (0.99)       | 0.70     | 0.50    |
| Intervention <sup>a</sup>               | 2.6 (0.99)         | 2.0 (0.92)       | 1.7 (0.82)       | 31.89*** | < 0.001 |
| Toddler's mood in morning <sup>^</sup>  |                    |                  |                  |          |         |
| Control                                 | 2.0 (0.83)         | 2.0 (0.79)       | 2.0 (0.83)       | 0.05     | 0.95    |
| Intervention <sup>a</sup>               | 2.2 (0.88)         | 1.7 (0.70)       | 1.8 (0.75)       | 15.39*** | < 0.001 |
| Number of times called                  |                    |                  |                  |          |         |
| Control                                 | 1.5 (1.27)         | 1.5 (1.38)       | 1.4 (1.07)       | 0.37     | 0.69    |
| Intervention <sup>b</sup>               | 1.8 (1.53)         | 1.3 (1.32)       | 1.1 (1.25)       | 8.21***  | < 0.001 |
| Number of times out of crib/bed         |                    |                  |                  |          |         |
| Control                                 | 1.2 (1.58)         | 1.1 (1.41)       | 1.2 (1.58)       | 0.16     | 0.85    |
| Intervention <sup>a</sup>               | 1.2 (1.11)         | 0.7 (0.79)       | 0.7 (0.88)       | 6.93**   | 0.001   |
| How difficult was bedtime? <sup>^</sup> |                    |                  |                  |          |         |
| Control                                 | 2.5 (0.80)         | 2.5 (0.85)       | 2.4 (0.89)       | 0.74     | 0.48    |
| Intervention <sup>a</sup>               | 2.5 (0.83)         | 2.0 (0.63)       | 1.8 (0.66)       | 34.89*** | < 0.001 |
| How well did child sleep? <sup>^</sup>  |                    |                  |                  |          |         |
| Control                                 | 2.2 (0.76)         | 2.0 (0.66)       | 2.1 (0.70)       | 0.78     | 0.46    |
| Intervention <sup>a</sup>               | 2.3 (0.86)         | 1.7 (0.68)       | 1.6 (0.69)       | 32.77*** | < 0.001 |

<sup>a</sup>Significant difference between baseline/week 2 and baseline/week 3

<sup>b</sup>Significant difference between baseline and week 3

<sup>^</sup>Lower scores are better

BISQ: Brief Infant Sleep Questionnaire; min: minutes; SD: standard deviation

cause of the multiple analyses conducted, findings were considered significant if  $P < 0.001$ .

## RESULTS

### Sleep Patterns

#### BISQ

For all sleep variables, no significant differences were found for any variable across the 3 weeks for the 2 control groups (Tables 2 and 3). For infants (Table 2), significant differences were found for multiple sleep variables following the institution of the bedtime routine compared to baseline. Overall, infants had decreased sleep onset latency, decreased number/duration of night wakings, increased sleep continuity, and decreased per-

ception by mothers of sleep as a problem,  $P < 0.001$ . There was no change in nap duration,  $P = 0.57$ , and a nonsignificant effect for total nighttime sleep,  $P = 0.006$ . Similar results were observed for toddlers, with significant improvements in number/duration of night wakings, sleep continuity, and parental perception of sleep as a problem and morning mood,  $P < 0.001$ . There were also decreases in parental report of number of times the child called out and number of times the child climbed out of the crib/bed,  $P < 0.001$ . No significant changes were found for sleep onset latency,  $P = 0.01$ ; total nighttime sleep,  $P = 0.61$ ; or nap duration,  $P = 0.44$ .

As seen in Tables 2 and 3, post hoc analyses (Tukey HSD) indicate that for all sleep variables, for both infants and toddlers, significant differences occurred between baseline and both week 2 and week 3. There were no differences for any sleep variable between week 2 and week 3.

**Table 4**—Sleep-Wake Patterns for Infants (Daily Sleep Diary)

| Variable                                | Baseline<br>M (SD) | Week 2<br>M (SD) | Week 3<br>M (SD) | ANOVA    |         |
|---|--------------------|------------------|------------------|----------|---------|
|   |                    |                  |                  | F        | P       |
| Sleep latency (min)                     |                    |                  |                  |          |         |
| Control                                 | 19.8 (12.45)       | 17.9 (12.86)     | 16.7 (12.81)     | 1.08     | 0.34    |
| Intervention <sup>a</sup>               | 19.9 (11.69)       | 14.0 (10.35)     | 13.4 (10.46)     | 14.68*** | < 0.001 |
| Time started routine                    |                    |                  |                  |          |         |
| Control                                 | 8:08 (1.25)        | 8:11 (1.06)      | 8:08 (1.18)      | 0.03     | 0.97    |
| Intervention                            | 8:05 (.80)         | 8:03 (0.23)      | 8:04 (0.22)      | 0.10     | 0.90    |
| Time of lights out (hours)              |                    |                  |                  |          |         |
| Control                                 | 8:50 (1.15)        | 8:49 (1.13)      | 8:49 (1.12)      | 0.02     | 0.98    |
| Intervention                            | 8:46 (0.80)        | 8:40 (0.77)      | 8:40 (0.80)      | 0.81     | 0.45    |
| Longest continuous sleep period (hours) |                    |                  |                  |          |         |
| Control                                 | 7.3 (2.17)         | 7.6 (2.30)       | 7.6 (2.23)       | 0.42     | 0.66    |
| Intervention <sup>a</sup>               | 6.9 (1.68)         | 8.1 (1.85)       | 8.5 (1.91)       | 26.55*** | < 0.001 |
| Number of night wakings                 |                    |                  |                  |          |         |
| Control                                 | 1.2 (0.95)         | 1.1 (0.89)       | 1.1 (0.90)       | 0.26     | 0.77    |
| Intervention <sup>a</sup>               | 1.4 (0.75)         | 1.0 (0.77)       | 0.9 (0.70)       | 19.50*** | < 0.001 |
| Duration of night wakings (min)         |                    |                  |                  |          |         |
| Control                                 | 20.9 (18.37)       | 17.5 (16.90)     | 18.6 (20.25)     | 0.62     | 0.54    |
| Intervention <sup>a</sup>               | 25.4 (16.60)       | 16.3 (14.26)     | 13.3 (14.42)     | 24.73*** | < 0.001 |
| How easy was bedtime? <sup>^</sup>      |                    |                  |                  |          |         |
| Control                                 | 2.1 (0.71)         | 2.0 (0.70)       | 1.9 (0.73)       | 1.90     | 0.15    |
| Intervention <sup>a</sup>               | 2.4 (0.64)         | 1.8 (0.55)       | 1.7 (0.57)       | 63.24*** | < 0.001 |
| Wake time                               |                    |                  |                  |          |         |
| Control                                 | 7:32 (1.06)        | 7:29 (1.08)      | 7:24 (1.03)      | 0.23     | 0.80    |
| Intervention                            | 7:31 (0.86)        | 7:32 (0.90)      | 7:33 (0.90)      | 0.01     | 0.99    |
| How well baby slept <sup>^</sup>        |                    |                  |                  |          |         |
| Control                                 | 2.3 (0.81)         | 2.1 (0.79)       | 2.2 (0.85)       | 1.13     | 0.32    |
| Intervention <sup>a</sup>               | 2.7 (0.71)         | 2.1 (0.72)       | 1.9 (0.76)       | 51.36*** | < 0.001 |
| Baby's mood in the morning <sup>^</sup> |                    |                  |                  |          |         |
| Control                                 | 2.0 (0.75)         | 1.9 (0.71)       | 1.8 (0.70)       | 0.53     | 0.59    |
| Intervention <sup>a</sup>               | 2.3 (0.72)         | 1.9 (0.70)       | 1.8 (0.74)       | 21.10*** | < 0.001 |
| Total naps (hours)                      |                    |                  |                  |          |         |
| Control                                 | 2.5 (1.11)         | 2.4 (1.01)       | 2.3 (.95)        | 0.41     | 0.66    |
| Intervention                            | 2.2 (0.89)         | 2.2 (0.89)       | 2.3 (.97)        | 0.14     | 0.87    |

<sup>a</sup>Significant difference between baseline/week 2 and baseline/week 3

<sup>b</sup>Start of routine, Lights out, Wake Time expressed by 24-Hour clock, SD expressed in hours

<sup>^</sup>Lower scores are better

min: minutes; SD: standard deviation

## Sleep Diary

Similar results were noted according to parental sleep diary (Tables 4 and 5). For infants, following implementation of a consistent bedtime routine, improvements were found in sleep onset latency, sleep continuity, number/duration of night wakings, and parental perceptions of how well the child slept and the child's mood in the morning,  $P < 0.001$ . No changes were noted in the time parents started the bedtime routine or lights out, wake time, or nap duration,  $P > 0.05$ . For toddlers in the routine group, there were significant decreases in sleep onset latency, sleep continuity, and number/duration of night wakings, as well as improvements in parental perception of bedtime ease, how well their child slept, and morning mood,  $P < 0.001$ . No changes were noted in the time at which the bedtime routine was started or the time of turning off the light ("lights out"), wake time, or nap duration,  $P > 0.05$ . For the control group, no significant changes were found for any variable.

## Mood State

Again, no significant differences were found for maternal mood for either the infant or toddler control group across the 3 weeks (Table 6). Significant improvements for mothers of infants in the routine group were found for all subscales of the POMS, including tension, depression, anger, fatigue, vigor, and confusion,  $P < 0.001$ . For mothers of toddlers in the routine group, there were significant improvements in tension, anger, fatigue, and confusion,  $P < 0.001$ . As seen in Tables 2 and 3, post hoc analyses (Tukey HSD) indicate that significant differences were found between baseline and both week 2 and week 3 for all significant subscales of the POMS, for both mothers of infants and toddlers.

## DISCUSSION

The results of this study suggest that instituting a consistent nightly bedtime routine is beneficial in improving multiple as-

**Table 5**—Sleep-Wake Patterns for Toddlers (Daily Sleep Diary)

| Variable                                   | Baseline<br>M (SD) | Week 2<br>M (SD) | Week 3<br>M (SD) | ANOVA    |         |
|--|--------------------|------------------|------------------|----------|---------|
|  |                    |                  |                  | F        | P       |
| Sleep latency (min)                        |                    |                  |                  |          |         |
| Control                                    | 19.8 (12.45)       | 17.9 (12.86)     | 16.7 (12.81)     | 0.87     | 0.42    |
| Intervention <sup>a</sup>                  | 21.9 (11.43)       | 18.6 (11.85)     | 16.1 (9.25)      | 9.38***  | < 0.001 |
| Time started routine                       |                    |                  |                  |          |         |
| Control                                    | 8:19 (0.70)        | 8:18 (0.79)      | 8:22 (0.76)      | 0.21     | 0.81    |
| Intervention                               | 8:15 (0.74)        | 8:14 (0.71)      | 8:18 (0.83)      | 0.29     | 0.75    |
| Time of lights out (hours)                 |                    |                  |                  |          |         |
| Control                                    | 8:58 (0.76)        | 8:55 (0.75)      | 8:56 (0.77)      | 0.10     | 0.90    |
| Intervention                               | 8:53 (0.77)        | 8:48 (0.71)      | 8:53 (0.77)      | 0.54     | 0.58    |
| Longest continuous sleep period (hours)    |                    |                  |                  |          |         |
| Control                                    | 8.4 (1.59)         | 8.4 (1.57)       | 8.4 (1.59)       | 0.07     | 0.94    |
| Intervention <sup>a</sup>                  | 8.0 (1.57)         | 8.7 (1.58)       | 8.9 (1.53)       | 13.15*** | < 0.001 |
| Number of night wakings                    |                    |                  |                  |          |         |
| Control                                    | 0.8 (0.56)         | 0.7 (0.58)       | 0.7 (0.65)       | 0.30     | 0.74    |
| Intervention <sup>a</sup>                  | 1.0 (0.74)         | 0.6 (.57)        | 0.5 (0.57)       | 23.47*** | < 0.001 |
| Duration of night wakings (min)            |                    |                  |                  |          |         |
| Control                                    | 12.5 (14.90)       | 10.27 (10.74)    | 11.7 (14.14)     | 0.48     | 0.62    |
| Intervention <sup>a</sup>                  | 13.3 (12.23)       | 8.4 (10.4)       | 9.3 (.81)        | 12.88*** | < 0.001 |
| Number of times called                     |                    |                  |                  |          |         |
| Control                                    | 1.5 (1.41)         | 1.5 (1.87)       | 1.3 (1.95)       | 0.18     | 0.84    |
| Intervention <sup>a</sup>                  | 1.8 (1.89)         | 1.1 (1.10)       | 1.0 (1.15)       | 10.57*** | < 0.001 |
| Number of times got out of bed/crib        |                    |                  |                  |          |         |
| Control                                    | 1.0 (1.21)         | 1.0 (1.28)       | 0.9 (1.17)       | 0.20     | 0.82    |
| Intervention                               | 1.0 (0.92)         | 0.7 (0.70)       | 0.6 (0.79)       | 4.31     | 0.01    |
| How difficult was bedtime?                 |                    |                  |                  |          |         |
| Control                                    | 2.4 (0.62)         | 2.4 (0.72)       | 2.3 (0.73)       | 0.72     | 0.49    |
| Intervention <sup>a</sup>                  | 2.3 (0.58)         | 1.9 (0.49)       | 1.8 (0.55)       | 28.20*** | < 0.001 |
| Wake time                                  |                    |                  |                  |          |         |
| Control                                    | 7:35 (0.95)        | 7:32 (0.99)      | 7:42 (0.96)      | 0.53     | 0.59    |
| Intervention                               | 7:30 (0.87)        | 7:29 (0.88)      | 7:29 (0.90)      | 0.02     | 0.98    |
| Total sleep time (hours)                   |                    |                  |                  |          |         |
| Control                                    | 10.0 (0.88)        | 10.1 (0.95)      | 10.2 (.87)       | 0.58     | 0.56    |
| Intervention                               | 9.8 (0.79)         | 10.1 (0.82)      | 10.2 (.85)       | 2.10     | 0.12    |
| How well toddler slept <sup>^</sup>        |                    |                  |                  |          |         |
| Control                                    | 2.1 (0.49)         | 2.0 (0.57)       | 2.0 (0.54)       | 0.42     | 0.66    |
| Intervention <sup>a</sup>                  | 2.1 (0.63)         | 1.8 (0.60)       | 1.6 (0.56)       | 28.26*** | < 0.001 |
| Toddler's mood in the morning <sup>^</sup> |                    |                  |                  |          |         |
| Control                                    | 2.1 (0.65)         | 2.0 (0.74)       | 2.0 (0.72)       | 0.18     | 0.83    |
| Intervention <sup>a</sup>                  | 2.2 (0.73)         | 1.9 (0.58)       | 1.8 (0.63)       | 18.35*** | < 0.001 |
| Total naps (hours)                         |                    |                  |                  |          |         |
| Control                                    | 1.7 (0.65)         | 1.6 (0.75)       | 1.6 (0.75)       | 0.09     | 0.91    |
| Intervention                               | 1.7 (0.71)         | 1.7 (0.75)       | 1.7 (0.70)       | 0.04     | 0.96    |

<sup>a</sup>Significant difference between baseline/week 2 and baseline/week 3; <sup>b</sup>Start of routine, Lights out, Wake time expressed by 24-Hour clock, SD expressed in hours; <sup>^</sup>Lower scores are better; min: minutes; SD: standard deviation

pects of infant and toddler sleep, resulting in shorter sleep onset latency, decreased wakefulness after sleep onset, and increased sleep consolidation. No comparative changes were seen in the control group. Parental perception of sleep also changed, including perception of their child having a sleep problem, sleep quality, bedtime ease, and morning mood. In addition, maternal mood state improved following intervention.

As was expected, children fell asleep faster following the institution of the consistent bedtime routine, and there were improvements in bedtime behaviors. For example, toddlers were less likely to call out to their parents or get out of their crib/bed following institution of the bedtime routine. Although these

changes in bedtime behaviors were expected, what was surprising was that sleep throughout the night also improved, including a decrease in the number and duration of night wakings, as well as increased sleep consolidation.

There is a question as to the mechanism for these improvements in nighttime sleep. One possibility was that other changes were made by the parents in this study beyond the institution of the bedtime routine. However, this did not seem to be the case. For example, no differences in the children's schedules were found following institution of the bedtime routine, including bedtimes and wake times. Furthermore, no recommendations were made regarding how children fell asleep, thus there were

**Table 6**—Maternal Mood for Infants and Toddlers (POMS)

| Variable                  | Baseline<br>M (SD) | Week 2<br>M (SD) | Week 3<br>M (SD) | ANOVA    |         |
|---------------------------|--------------------|------------------|------------------|----------|---------|
|                           |                    |                  |                  | F        | P       |
| <b>Infants</b>            |                    |                  |                  |          |         |
| Tension <sup>^</sup>      |                    |                  |                  |          |         |
| Control                   | 7.4 (4.89)         | 7.0 (5.01)       | 5.7 (3.99)       | 2.73     | 0.07    |
| Intervention <sup>a</sup> | 8.4 (5.28)         | 5.4 (3.57)       | 4.2 (3.44)       | 34.83*** | < 0.001 |
| Depression <sup>^</sup>   |                    |                  |                  |          |         |
| Control                   | 4.9 (5.97)         | 4.3 (5.01)       | 3.4 (4.63)       | 1.54     | 0.22    |
| Intervention <sup>a</sup> | 6.2 (7.22)         | 2.9 (5.63)       | 1.7 (2.77)       | 22.69*** | < 0.001 |
| Anger <sup>^</sup>        |                    |                  |                  |          |         |
| Control                   | 4.9 (3.79)         | 4.7 (4.53)       | 3.5 (3.65)       | 2.08     | 0.13    |
| Intervention <sup>a</sup> | 5.9 (5.89)         | 2.7 (3.20)       | 2.0 (3.12)       | 31.49*** | < 0.001 |
| Fatigue <sup>^</sup>      |                    |                  |                  |          |         |
| Control                   | 8.0 (5.57)         | 7.4 (5.68)       | 5.7 (4.72)       | 3.78     | 0.02    |
| Intervention <sup>a</sup> | 9.9 (6.20)         | 5.4 (4.79)       | 4.1 (4.53)       | 43.79*** | < 0.001 |
| Vigor <sup>+</sup>        |                    |                  |                  |          |         |
| Control                   | 13.6 (6.60)        | 13.6 (7.31)      | 13.9 (7.70)      | 0.03     | 0.97    |
| Intervention <sup>a</sup> | 12.3 (6.06)        | 15.0 (5.59)      | 16.0 (6.21)      | 14.26*** | < 0.001 |
| Confusion <sup>^</sup>    |                    |                  |                  |          |         |
| Control                   | 5.7 (3.95)         | 5.2 (3.72)       | 4.5 (3.60)       | 1.97     | 0.14    |
| Intervention <sup>a</sup> | 6.0 (4.10)         | 3.9 (2.76)       | 3.2 (2.56)       | 27.57*** | < 0.001 |
| <b>Toddlers</b>           |                    |                  |                  |          |         |
| Tension <sup>^</sup>      |                    |                  |                  |          |         |
| Control                   | 8.2 (5.22)         | 8.1 (5.35)       | 6.9 (4.93)       | 1.27     | 0.28    |
| Intervention <sup>a</sup> | 8.9 (5.10)         | 6.5 (4.15)       | 5.7 (4.49)       | 17.34*** | < 0.001 |
| Depression <sup>^</sup>   |                    |                  |                  |          |         |
| Control                   | 5.9 (8.51)         | 5.0 (7.87)       | 4.4 (8.32)       | 0.54     | 0.59    |
| Intervention <sup>a</sup> | 5.6 (6.92)         | 3.7 (5.38)       | 3.1 (6.13)       | 5.90***  | 0.003   |
| Anger <sup>^</sup>        |                    |                  |                  |          |         |
| Control                   | 5.8 (5.85)         | 4.9 (5.16)       | 4.4 (5.95)       | 0.96     | 0.39    |
| Intervention <sup>a</sup> | 6.2 (5.43)         | 4.3 (4.80)       | 3.6 (4.94)       | 9.19***  | < 0.001 |
| Fatigue <sup>^</sup>      |                    |                  |                  |          |         |
| Control                   | 8.7 (5.65)         | 7.5 (4.95)       | 7.1 (5.81)       | 1.51     | 0.22    |
| Intervention <sup>a</sup> | 9.5 (5.43)         | 6.9 (4.86)       | 5.9 (5.23)       | 16.90*** | < 0.001 |
| Vigor <sup>+</sup>        |                    |                  |                  |          |         |
| Control                   | 14.0 (5.55)        | 14.1 (5.84)      | 14.6 (5.74)      | 0.27     | 0.77    |
| Intervention <sup>a</sup> | 13.0 (6.13)        | 14.2 (5.68)      | 14.2 (6.34)      | 1.70     | 0.18    |
| Confusion <sup>^</sup>    |                    |                  |                  |          |         |
| Control                   | 5.6 (4.11)         | 5.6 (3.94)       | 4.8 (4.01)       | 0.73     | 0.48    |
| Intervention <sup>a</sup> | 6.3 (3.64)         | 4.9 (3.08)       | 4.4 (2.96s)      | 13.46*** | < 0.001 |

<sup>a</sup>Significant difference between baseline/week 2 and baseline/week 3; <sup>^</sup>Lower scores are better; <sup>+</sup>Higher scores are better; POMS: Profile of Mood States; SD: standard deviation

no changes in any negative sleep associations, which are typically the primary influence on night wakings.<sup>1</sup> Thus, it seems that the bedtime routine specifically improved nighttime sleep, as well as the expected changes at bedtime. Similar to studies on the impact of daily routines, the presence of a routine may in and of itself have resulted in overall improvements beyond the immediate behaviors.<sup>6-8</sup> It also may be that a bedtime routine led to an overall decrease in arousal level, resulting in improved sleep throughout the night beyond just bedtime. And the final possibility is that the inclusion of a bath as part of the recommended routine, which affects core body temperature, resulted in improved sleep. Studies in adults have found that a bath improves sleep,<sup>14,15</sup> and similar effects may have been found in this study.

In addition to the impact on the infants and toddlers, it is noteworthy that maternal mood improved concurrent with posi-

tive changes in the children's sleep. Given the design of this study, it is not possible to determine what led to the improvement in mood. It may be that as the children in this study slept better, mothers obtained more sleep, leading to improved mood. Another possibility is that with a designated bedtime routine, mothers of children with sleep issues felt more in control at bedtime, which resulted in improvements in mood, similar to previous studies that have reported decreased parental distress with institution of daily routines.<sup>6</sup> Future studies should include measures of maternal sleep and parental control to further elucidate this relationship.

There are a number of limitations to this study. First, this study was based on parental report without an objective measure of sleep, such as actigraphy. Future studies should include such additional measures. Second, the results may have been a result of demand characteristics in that there were expectations

that sleep would improve. However, it is quite interesting to note that changes were not observed for those sleep variables that would not be expected to be affected by the institution of a bedtime routine. For example, as discussed above, there was no change in rise times or nap duration for the infants and toddlers in either routine group. None of these variables should have been affected by the implementation of the bedtime routine. Another limitation was the lack of a longer-term follow-up. It is not known whether improvements in sleep were maintained following the 2-week intervention period. Future studies of the efficacy of implementation of a bedtime routine would benefit from longer-term follow-up. A final limitation was that only one specific bedtime routine was evaluated, with all families instituting the same routine of a bath, massage/lotion, and quiet activities. Thus, no conclusions can be made as to whether this specific routine led to the improvements in sleep or whether any routine would lead to improved sleep. Furthermore, this study did not allow for an evaluation of whether all components of the routine were essential. Further evaluation of a myriad of bedtime routines would help elucidate whether there are specific aspects of a bedtime routine that lead to more or less improvement in sleep.

Overall, this study found that institution of a consistent nightly bedtime routine improves sleep in infants and toddlers, as shown here with mild to moderate sleep problems. Such a routine appears to be highly efficacious; it can be easily adopted by practicing pediatricians and other pediatric providers as a routine recommendation for both prevention and treatment of sleep problems in young children. Primary care practitioners play an instrumental role in helping families institute positive sleep practices and improving sleep in infants and toddlers. This study provides pediatric practitioners with a simple message that parents can easily implement and one that requires minimal practitioner time.

#### DISCLOSURE STATEMENT

This study was supported by Johnson & Johnson Consumer Companies, Inc. Dr. Mindell has consulted for and participated in speaking engagements for Johnson & Johnson. The other authors are employees of Johnson & Johnson Consumer Companies, Inc.

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